2024 Ozone and Annual $PM_{2.5}$ Design Values

July 2025

Alpine Geophysics, LLC

Ozone and $PM_{2.5}$ Design Values (DV)

- All data obtained from EPA design value website (PM) and AirNow-Tech (Ozone)
  - https://www.epa.gov/air-trends/air-quality-design-values
  - https://www.airnowtech.org/

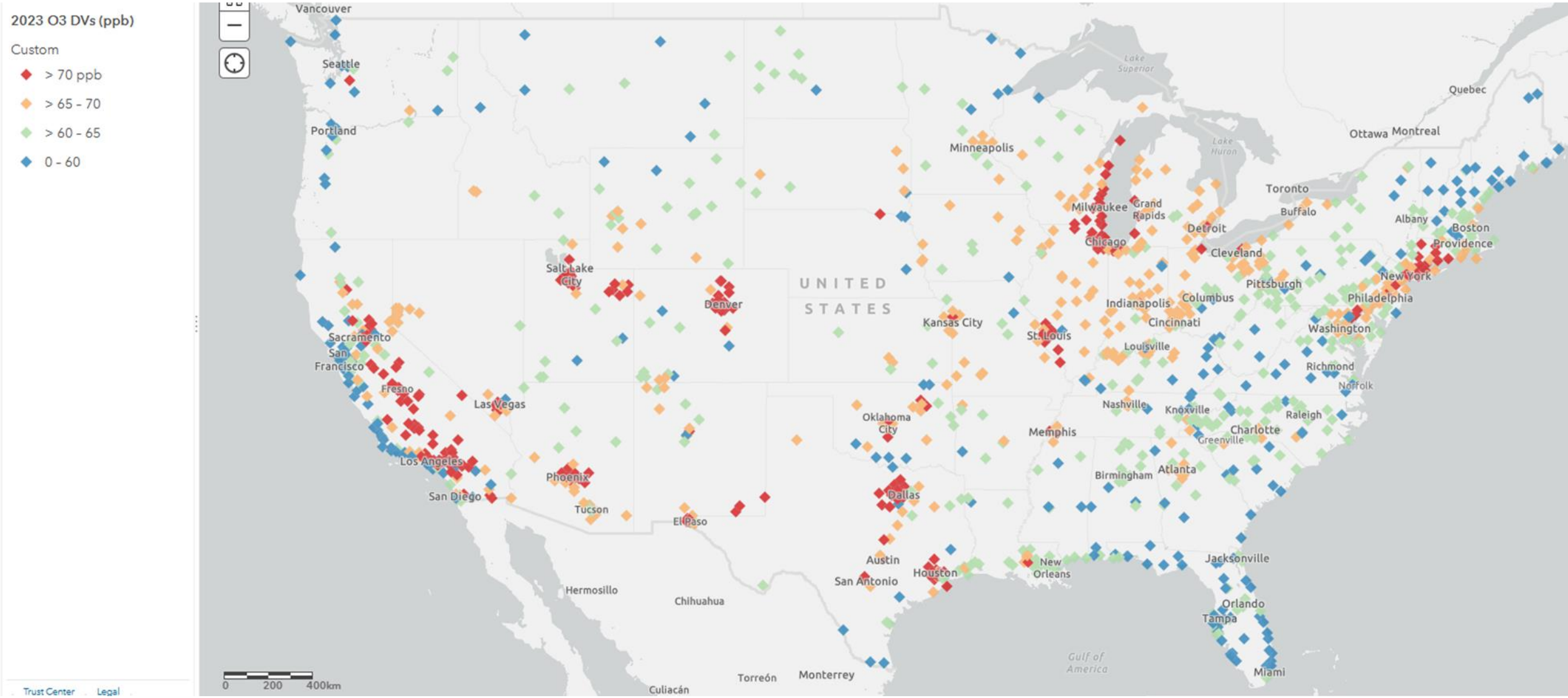
- 8-hour ozone design value (Current NAAQS = 70 ppb)
  - The design value is the annual fourth-highest daily maximum 8-hour ozone concentration averaged over three years (2022-2024)

- Annual $PM_{2.5}$ design value (Current NAAQS = 9.0 $\mu g/m^3$)
  - The design value is the annual arithmetic mean concentrations, averaged over 3 years (2022-2024)

- Design values presented also:
  - Include source-oriented monitors that are not used to support compliance with ambient air quality standards
  - Exclude recent, unacted upon exceptional events demonstrations submitted by states

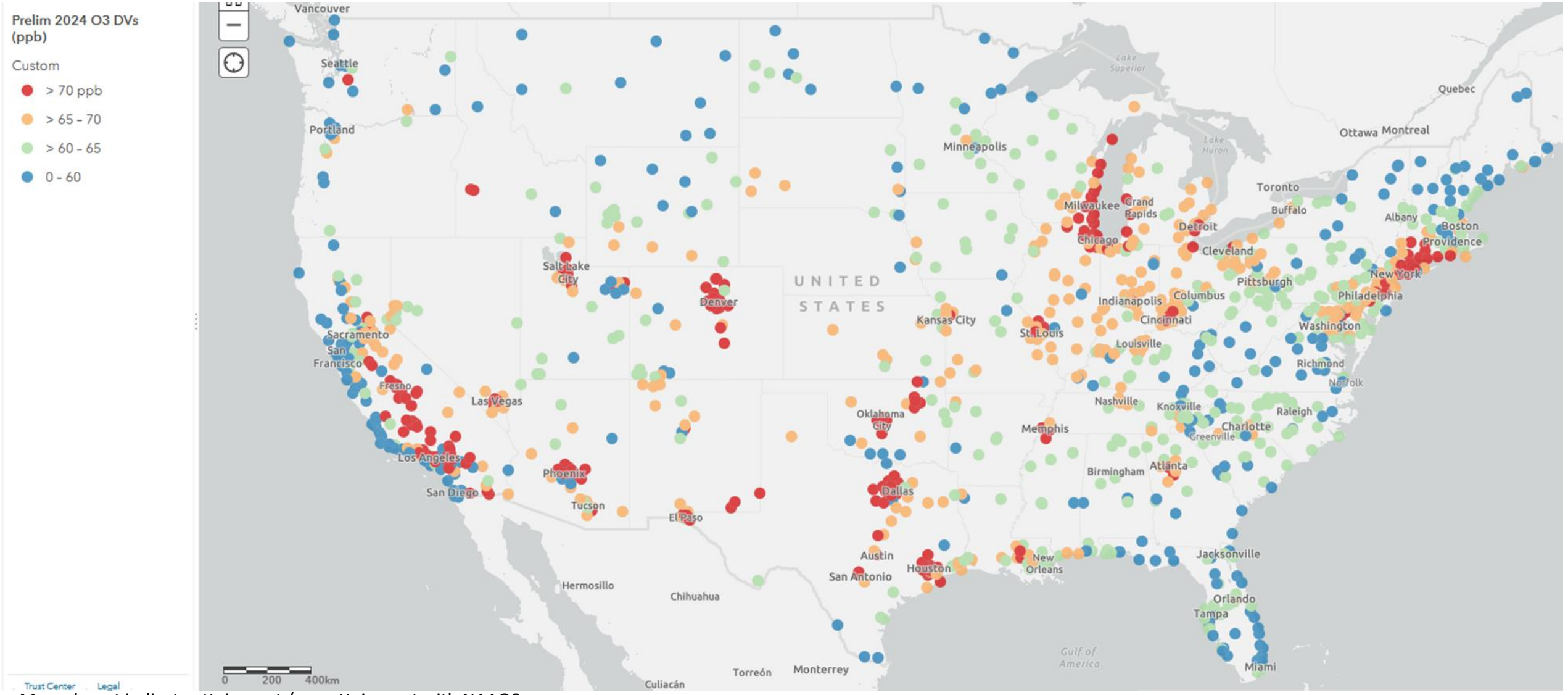
8-Hour Ozone Design Value Maps

2021-2023 Ozone DVs (ppb)



Maps do not indicate attainment / nonattainment with NAAQS, only current design value based on latest observations

2022-2024 Ozone DV (ppb)



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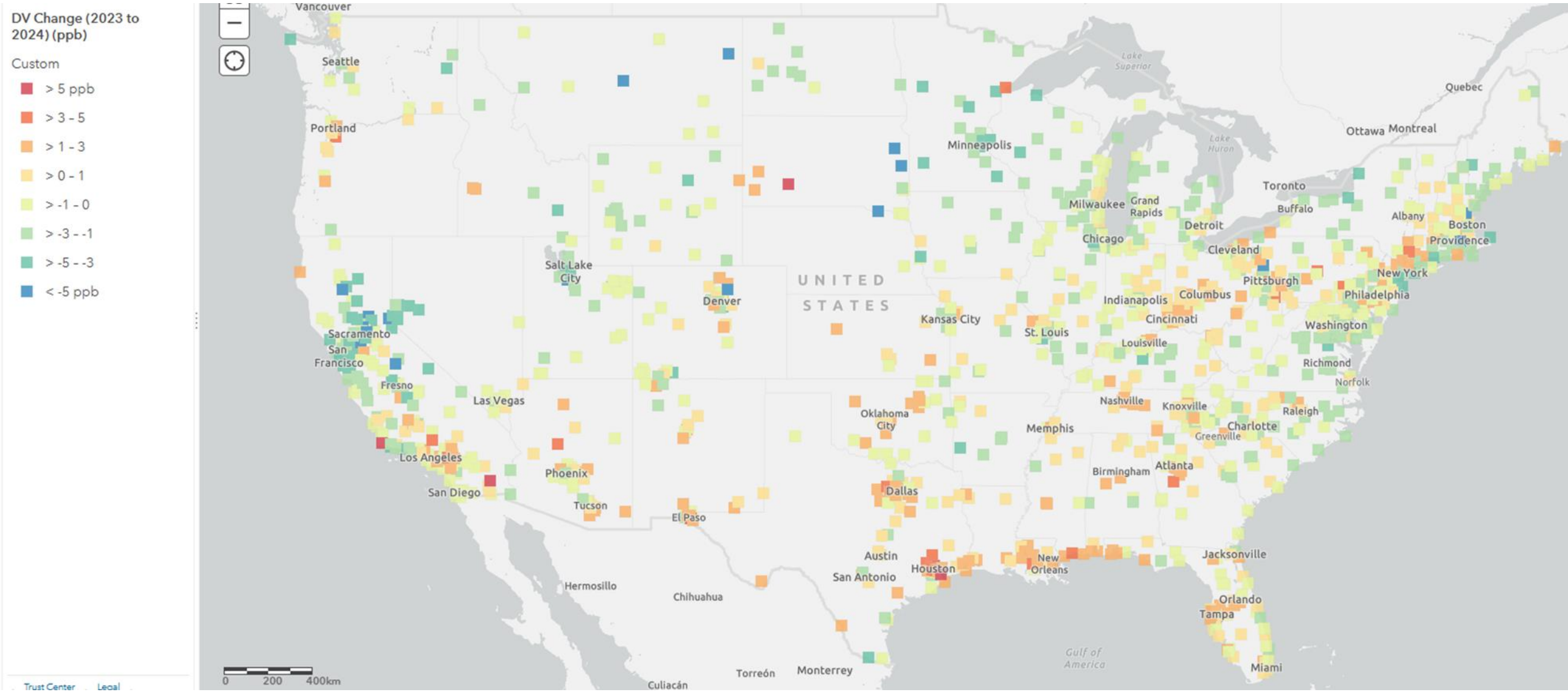
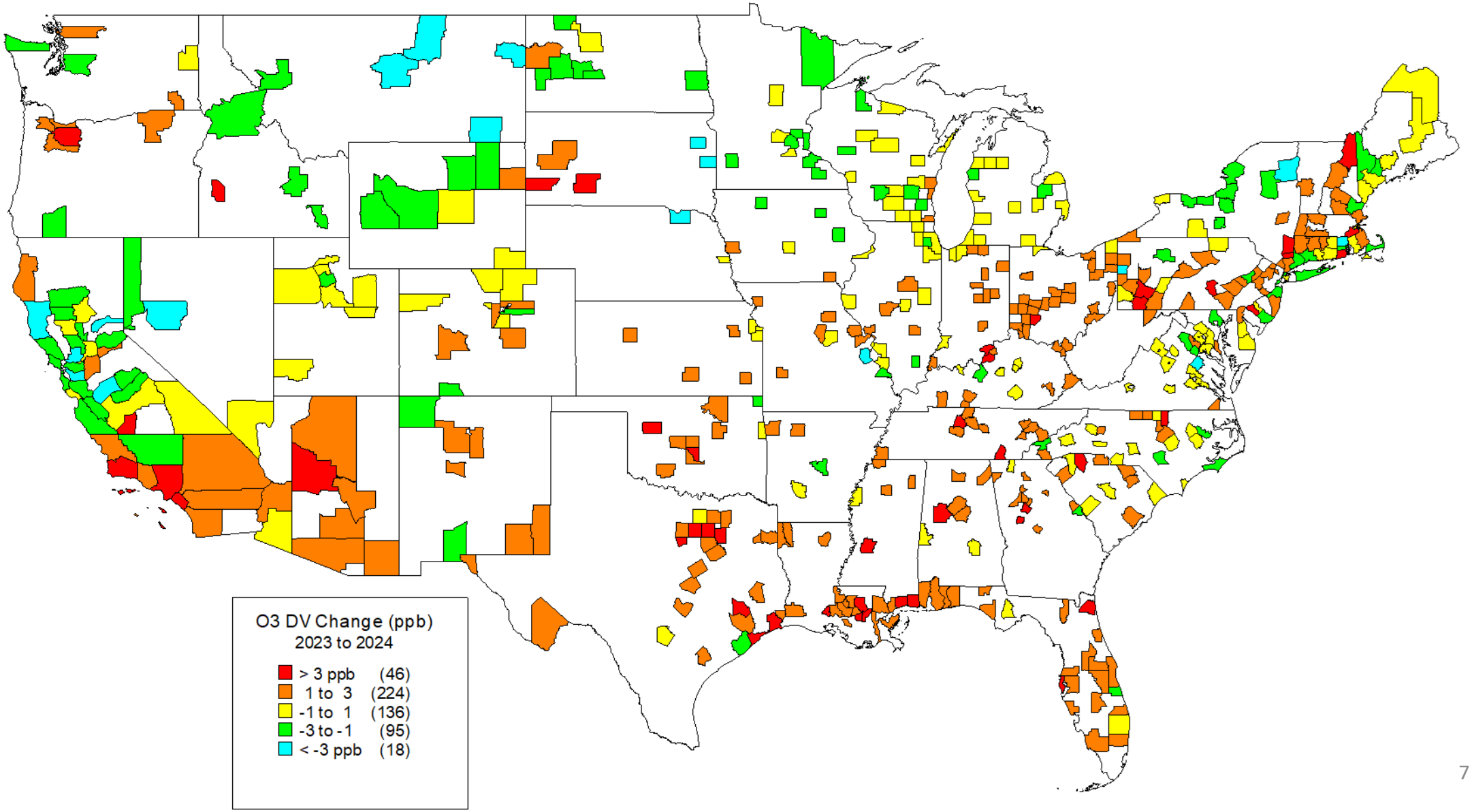
Change in Ozone DV (2023 to 2024)



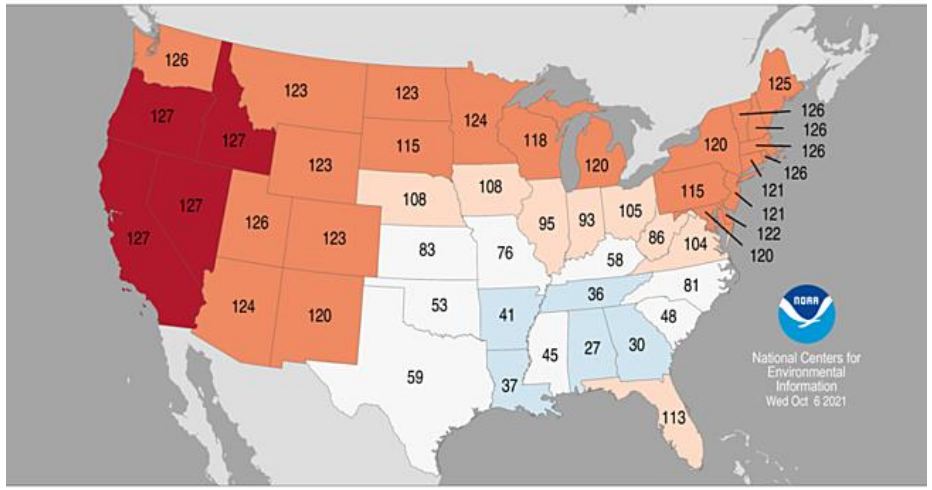
County Level Ozone DV Change from 2023 to 2024



Ozone and Temperature

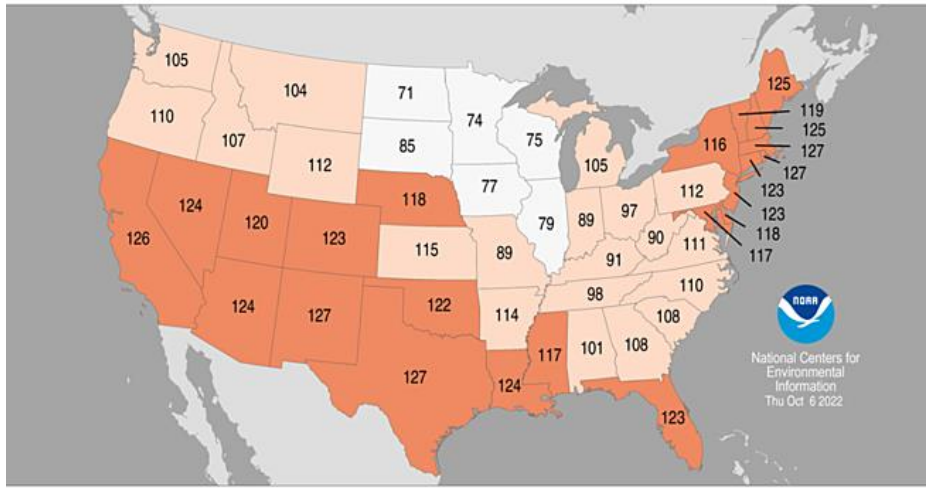
- Ozone and meteorology (temperature, wind patterns, and humidity) have a complex relationship
- In the troposphere, the layer closest to ground level, higher temperatures can lead to increased ozone formation, affecting air quality
- Even with documented reductions in ozone precursor emissions, recent ozone changes have been influenced by increasing average temperatures over the past few years
- The following slide shows that average statewide temperature ranks have been increasing and that 2024 includes some of the highest recorded state temperature averages in the past 130 years

Statewide Average Temperature Ranks
April – September 2021
Period: 1895–2021



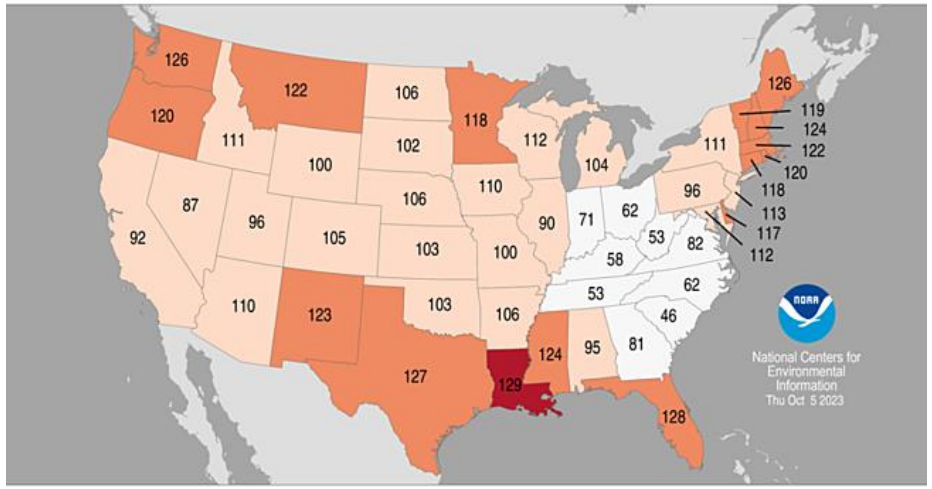
Record Coldest (1) | Much Below Average | Below Average | Near Average | Above Average | Much Above Average | Record Warmest (127)

Statewide Average Temperature Ranks
April – September 2022
Period: 1895–2022



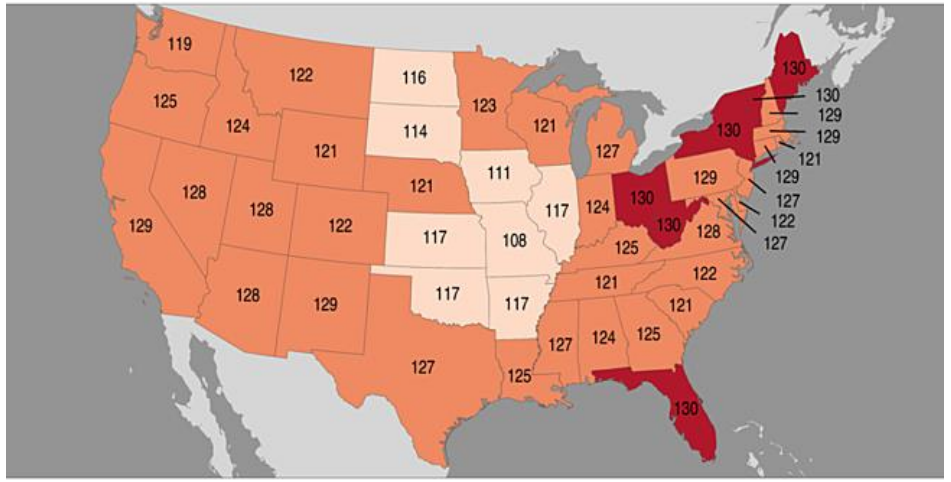
Record Coldest (1) | Much Below Average | Below Average | Near Average | Above Average | Much Above Average | Record Warmest (128)

Statewide Average Temperature Ranks
April – September 2023
Period: 1895–2023



Record Coldest (1) | Much Below Average | Below Average | Near Average | Above Average | Much Above Average | Record Warmest (129)

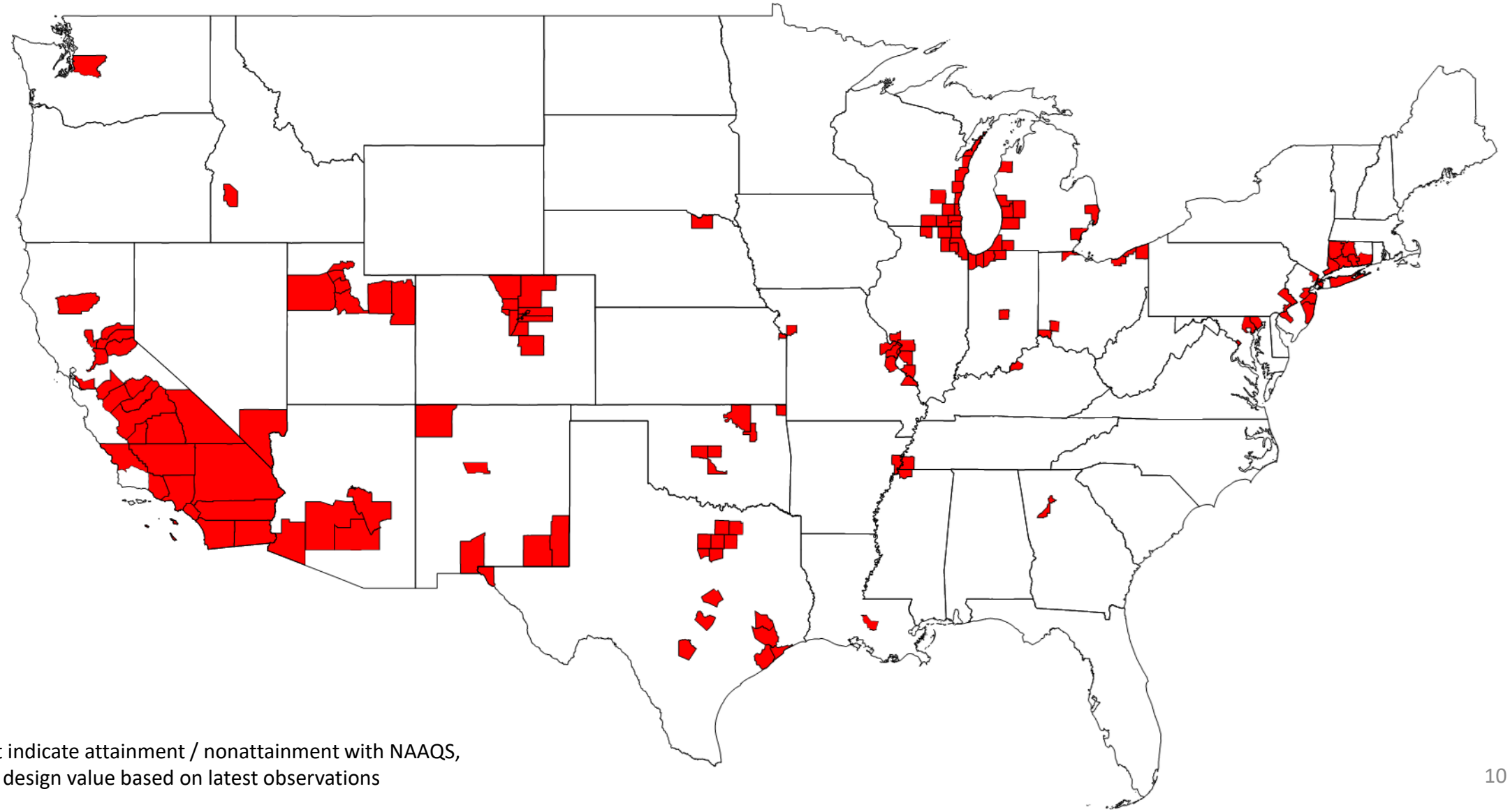
Statewide Average Temperature Ranks
April - September 2024
Ranking Period: 1895-2024
NOAA's National Centers for Environmental Information



Created: Mon Oct 21 2024
Source: nClimGrid - Monthly

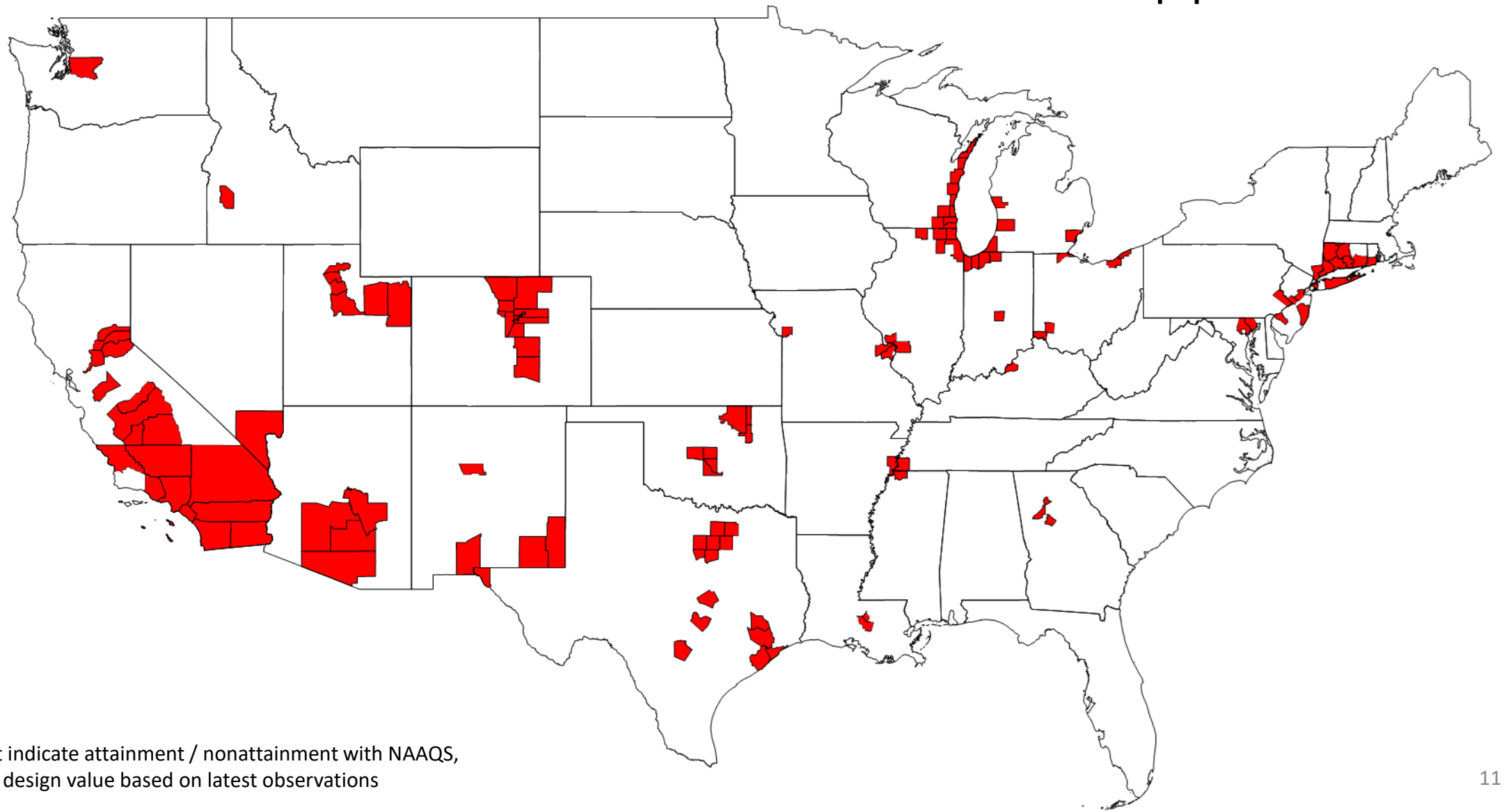
Record Coldest (1) | Much Below Average | Below Average | Near Average | Above Average | Much Above Average | Record Warmest (130)

Counties with 2021-2023 Ozone DV > 70 ppb



Maps do not indicate attainment / nonattainment with NAAQS, only current design value based on latest observations

Counties with 2022-2024 Ozone DV > 70 ppb



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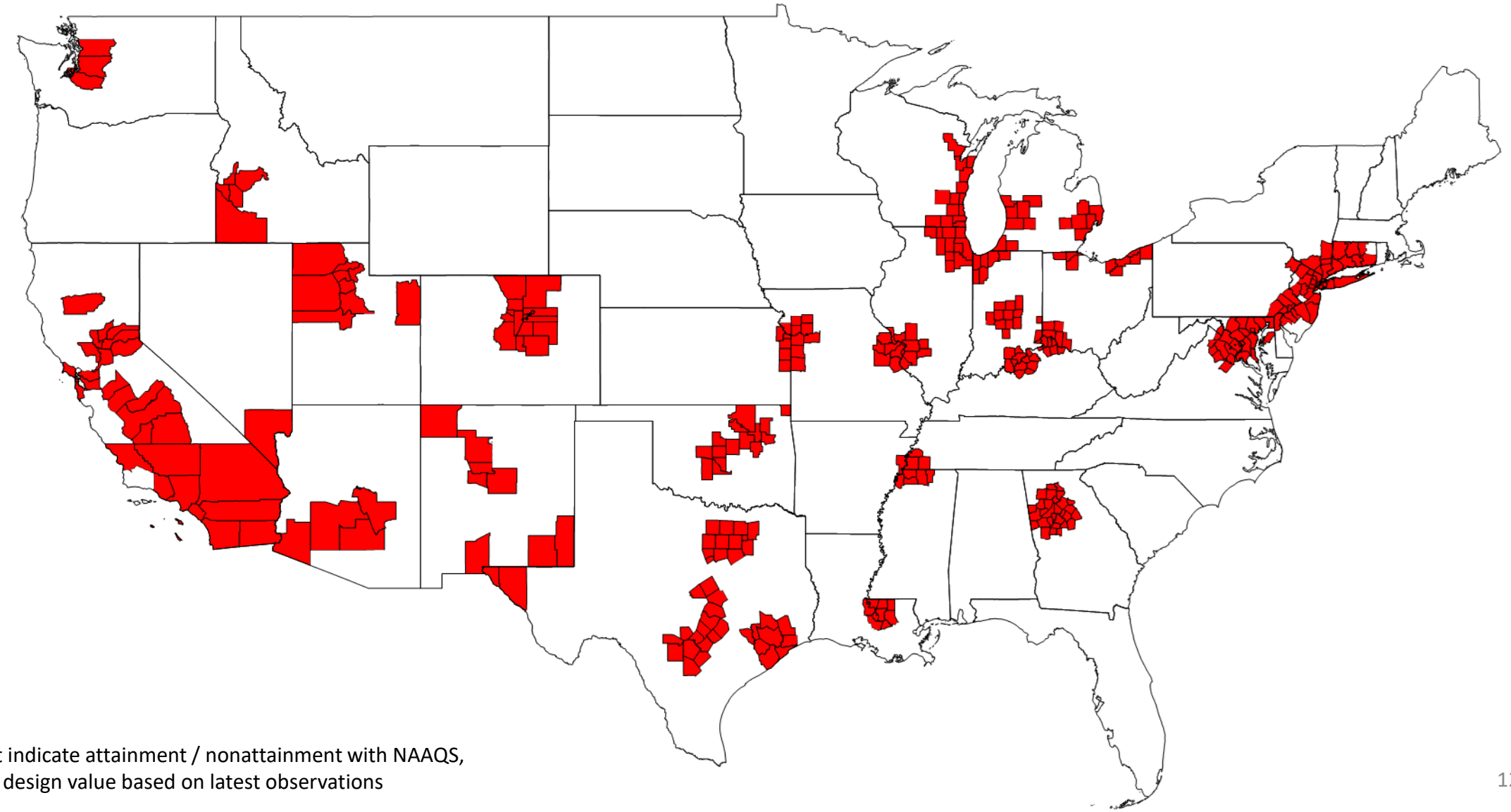
CBSAs with 2021-2023 Ozone DV > 70 ppb



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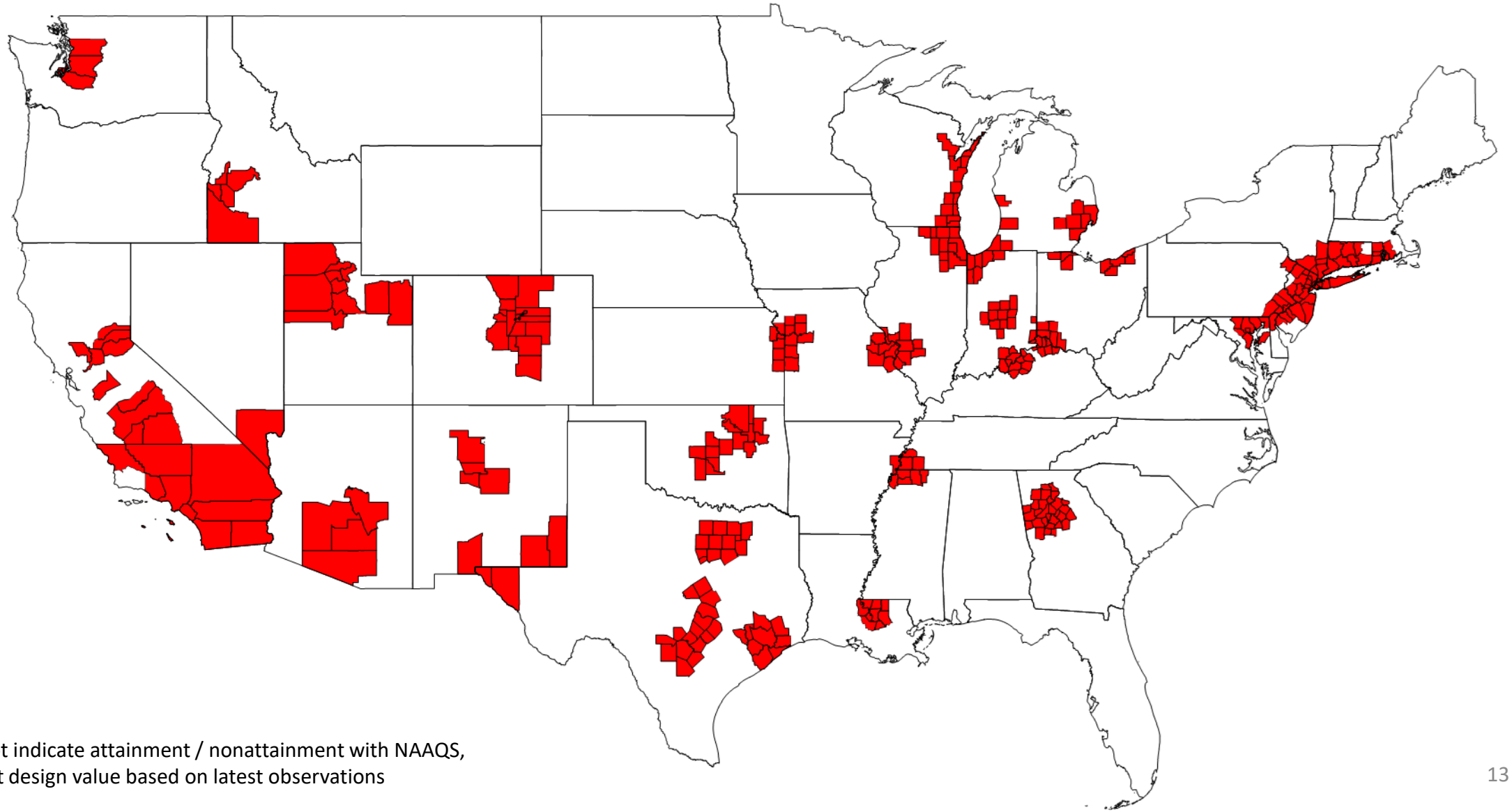
CBSAs with 2022-2024 Ozone DV > 70 ppb



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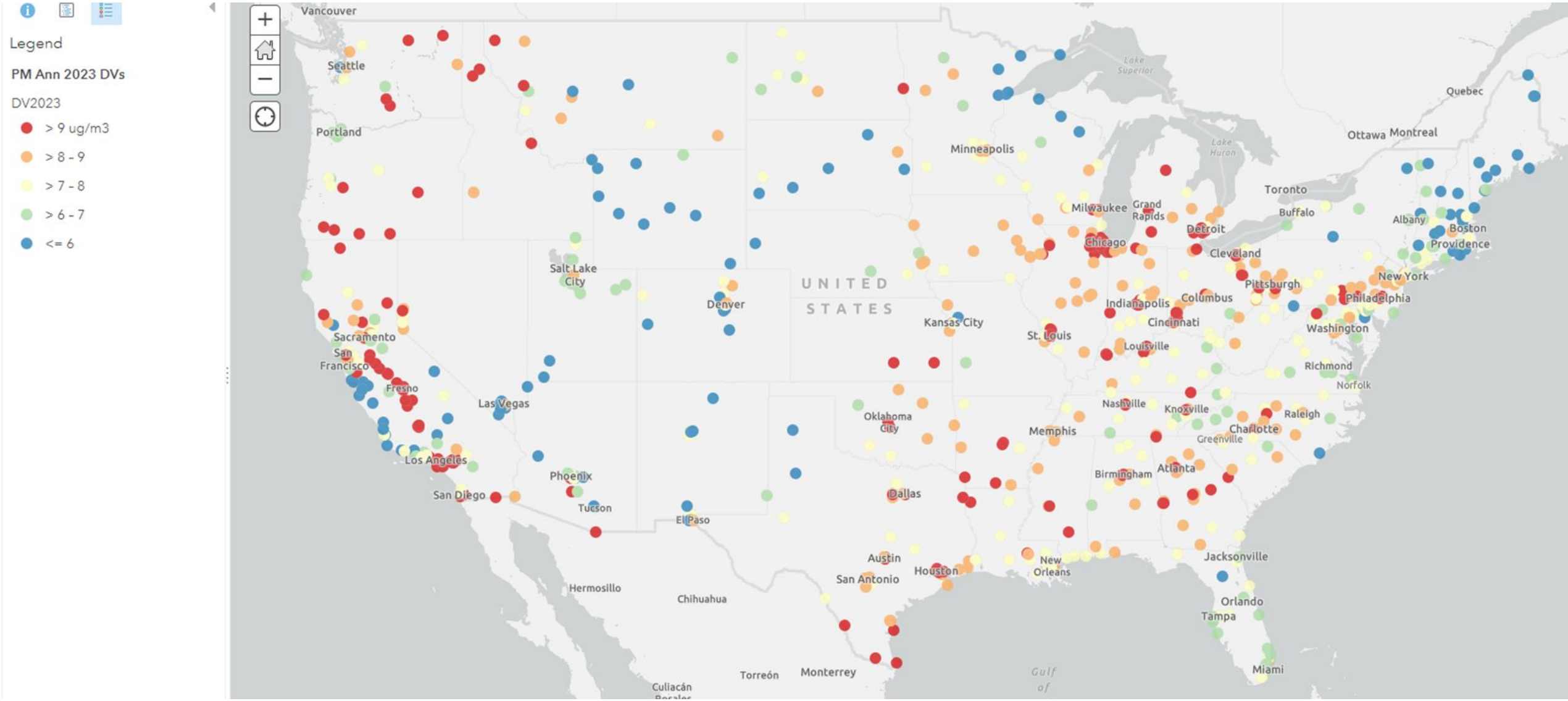
CBSAs with 2022-2024 Ozone DV > 70 ppb

CBSA Name	CBSA Value	CBSA Name	CBSA Value	CBSA Name	CBSA Value	CBSA Name	CBSA Value
Albuquerque, NM	72	El Paso, TX	76	Memphis, TN-MS-AR	73	Rockford, IL	71
Atlanta-Sandy Springs-Roswell, GA	72	Fort Collins, CO	75	Michigan City-La Porte, IN	71	Sacramento--Roseville--Arden-Arcade, CA	75
Austin-Round Rock, TX	72	Fresno, CA	83	Milwaukee-Waukesha-West Allis, WI	74	Salt Lake City, UT	75
Bakersfield, CA	88	Greeley, CO	73	Modesto, CA	79	San Antonio-New Braunfels, TX	75
Baltimore-Columbia-Towson, MD	71	Green Bay, WI	71	Muskegon, MI	76	San Diego-Carlsbad, CA	81
Bartlesville, OK	71	Hanford-Corcoran, CA	79	New Haven-Milford, CT	76	San Luis Obispo-Paso Robles-Arroyo Grande, CA	72
Baton Rouge, LA	74	Hartford-West Hartford-East Hartford, CT	74	New York-Newark-Jersey City, NY-NJ-PA	72	Seattle-Tacoma-Bellevue, WA	71
Boise City, ID	73	Hobbs, NM	72	Niles-Benton Harbor, MI	72	Sheboygan, WI	78
Boulder, CO	75	Holland, MI	74	Norwich-New London, CT	72	South Bend-Mishawaka, IN-MI	71
Bridgeport-Stamford-Norwalk, CT	80	Houston-The Woodlands-Sugar Land, TX	84	Ogden-Clearfield, UT	75	St. Louis, MO-IL	74
Carlsbad-Artesia, NM	80	Indianapolis-Carmel-Anderson, IN	71	Oklahoma City, OK	73	Toledo, OH	71
Chicago-Naperville-Elgin, IL-IN-WI	78	Kansas City, MO-KS	71	Oxnard-Thousand Oaks-Ventura, CA	76	Torrington, CT	72
Cincinnati, OH-KY-IN	72	Killeen-Temple, TX	72	Payson, AZ	77	Trenton, NJ	71
Cleveland-Elyria, OH	73	Las Cruces, NM	76	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	73	Truckee-Grass Valley, CA	71
Colorado Springs, CO	73	Las Vegas-Henderson-Paradise, NV	73	Phoenix-Mesa-Scottsdale, AZ	80	Tucson, AZ	71
Dallas-Fort Worth-Arlington, TX	83	Los Angeles-Long Beach-Anaheim, CA	101	Providence-Warwick, RI-MA	72	Tulsa, OK	73
Denver-Aurora-Lakewood, CO	81	Louisville/Jefferson County, KY-IN	75	Provo-Orem, UT	71	Vernal, UT	76
Detroit-Warren-Dearborn, MI	71	Madera, CA	77	Pueblo, CO	71	Visalia-Porterville, CA	88
El Centro, CA	77	Manitowoc, WI	73	Racine, WI	74	Whitewater-Elkhorn, WI	72
				Riverside-San Bernardino-Ontario, CA	108		

Table does not indicate attainment / nonattainment with NAAQS, only current design value based on latest observations
Values include source-oriented monitor observations that are not used to support compliance with ambient air quality standards

Annual $PM_{2.5}$ Design Value Maps

2021-2023 Annual $PM_{2.5}$ DV



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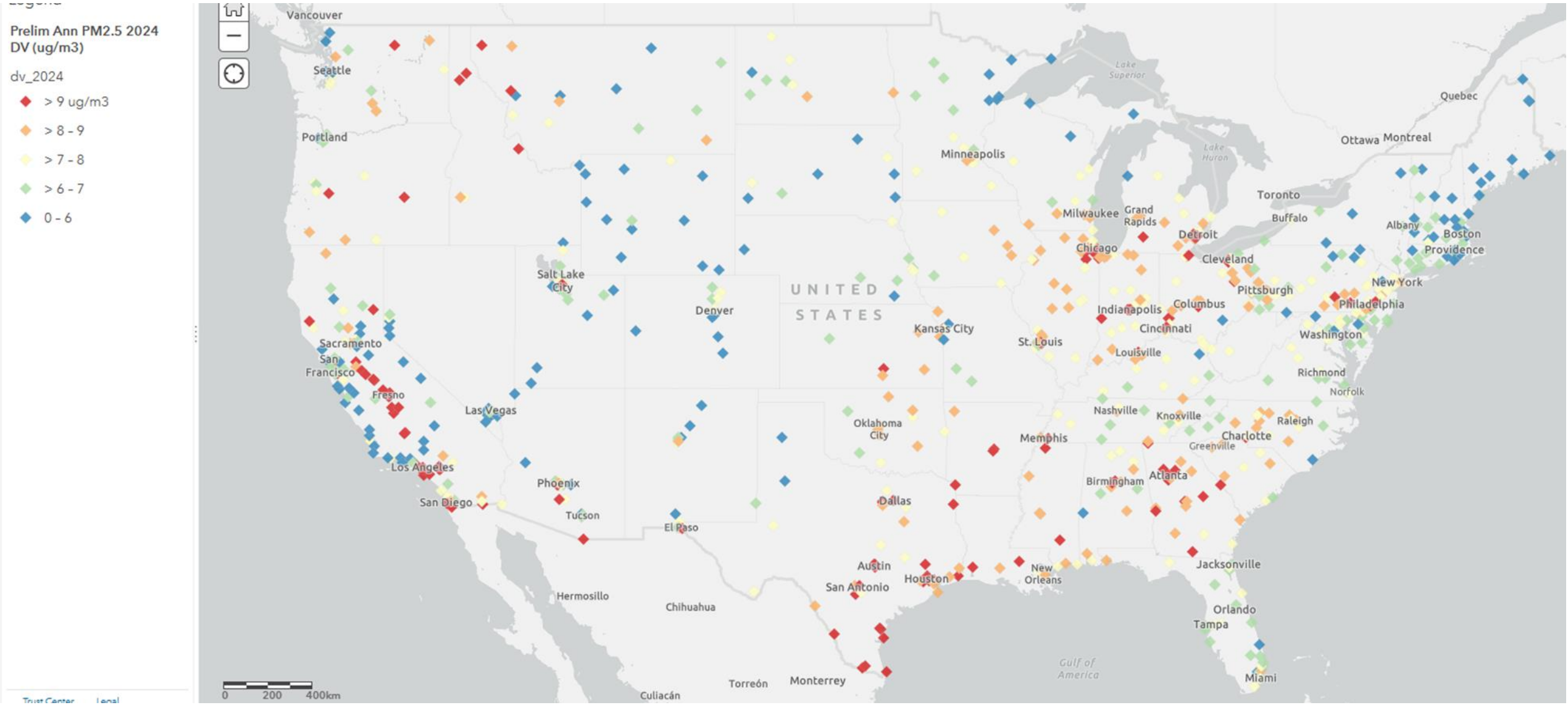
2022-2024 Annual $PM_{2.5}$ DV



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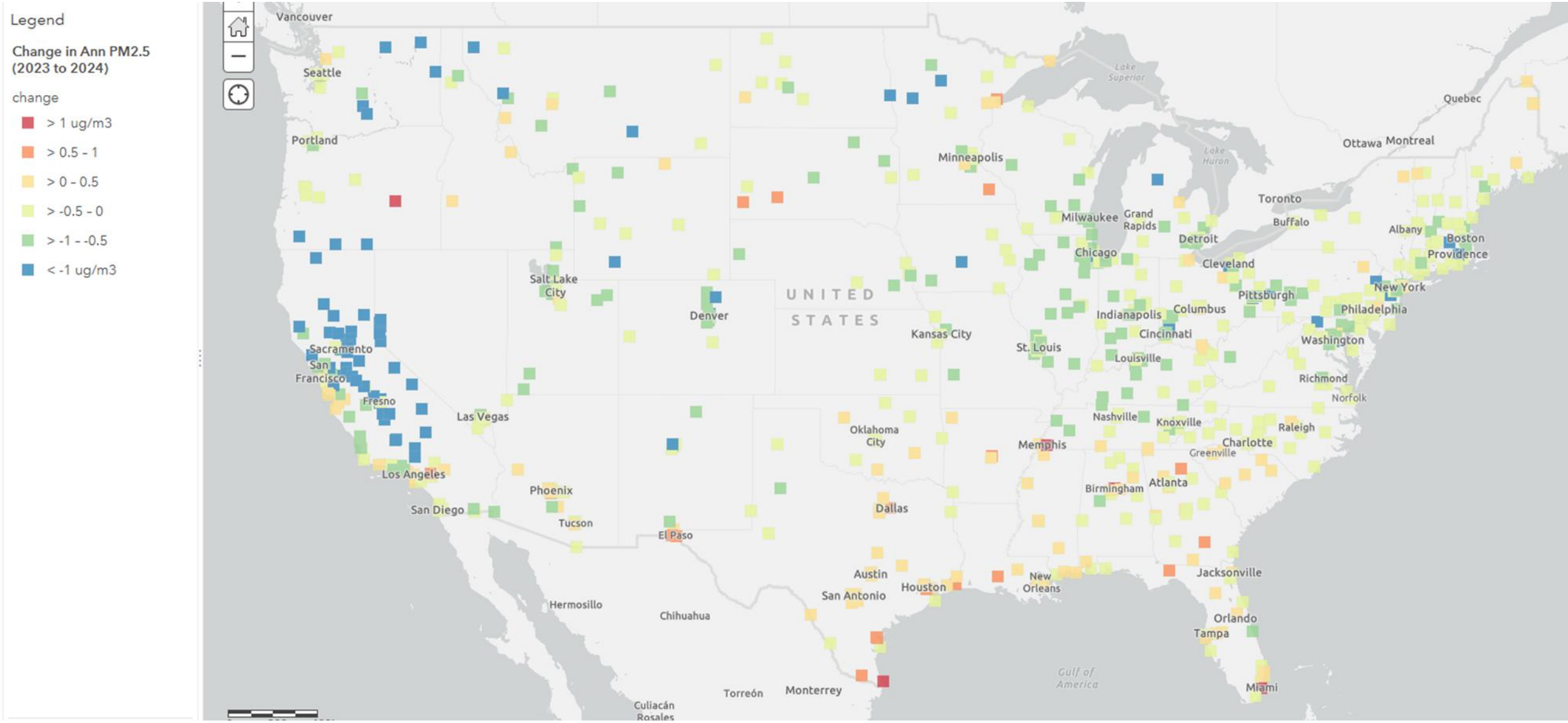
Change in Annual $PM_{2.5}$ DVs (2023 – 2024)



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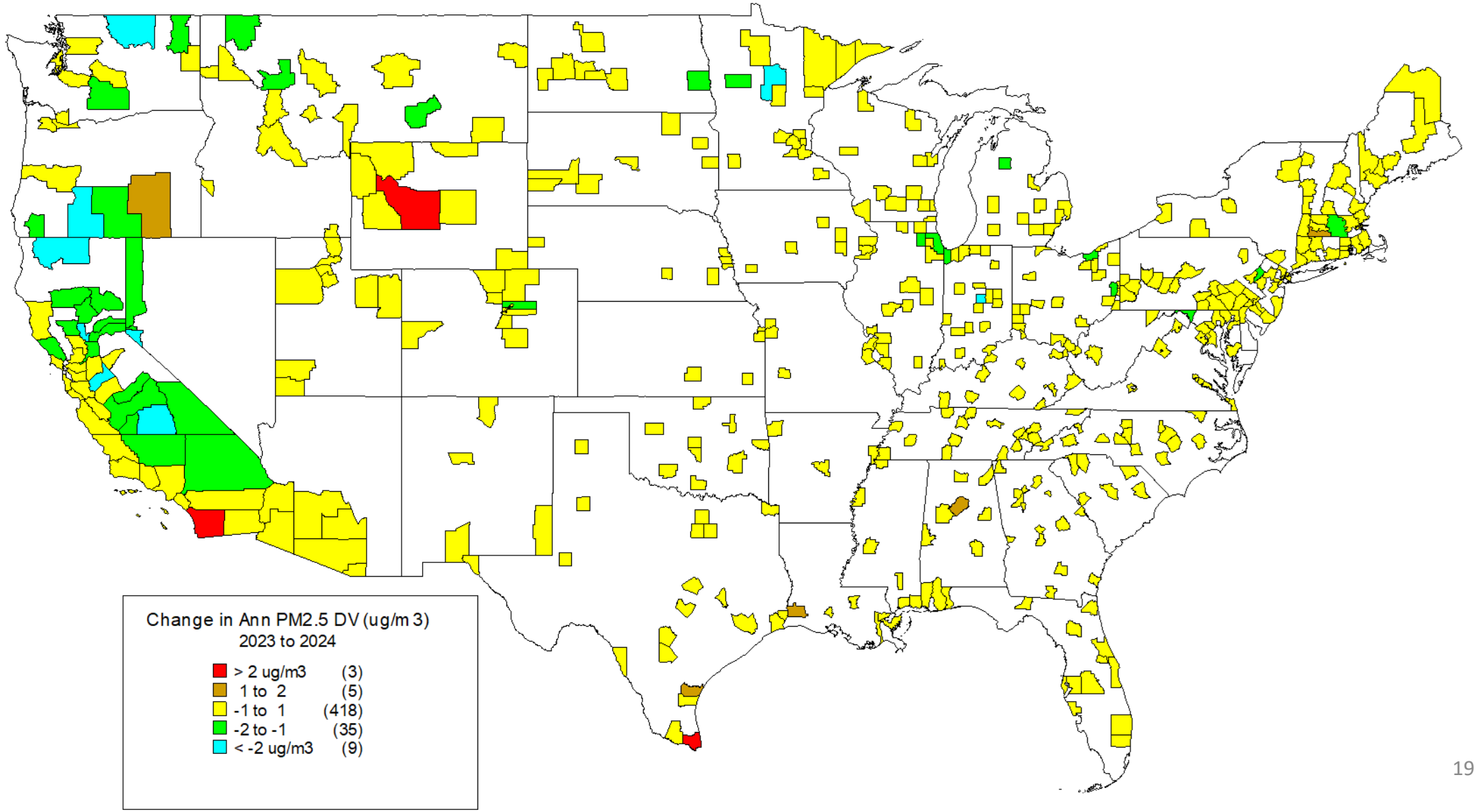
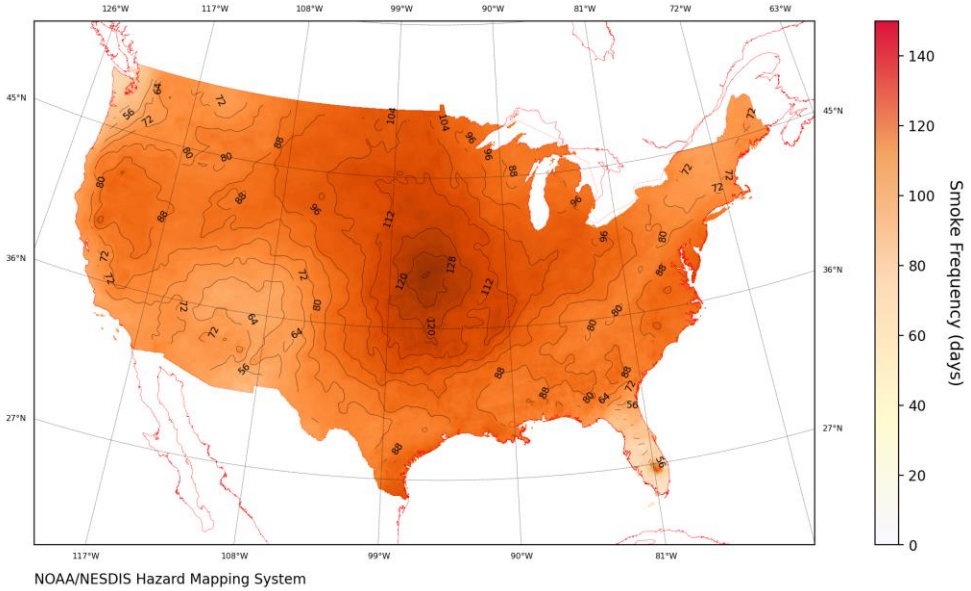
County Level Annual $PM_{2.5}$ DV Change (2023-2024)



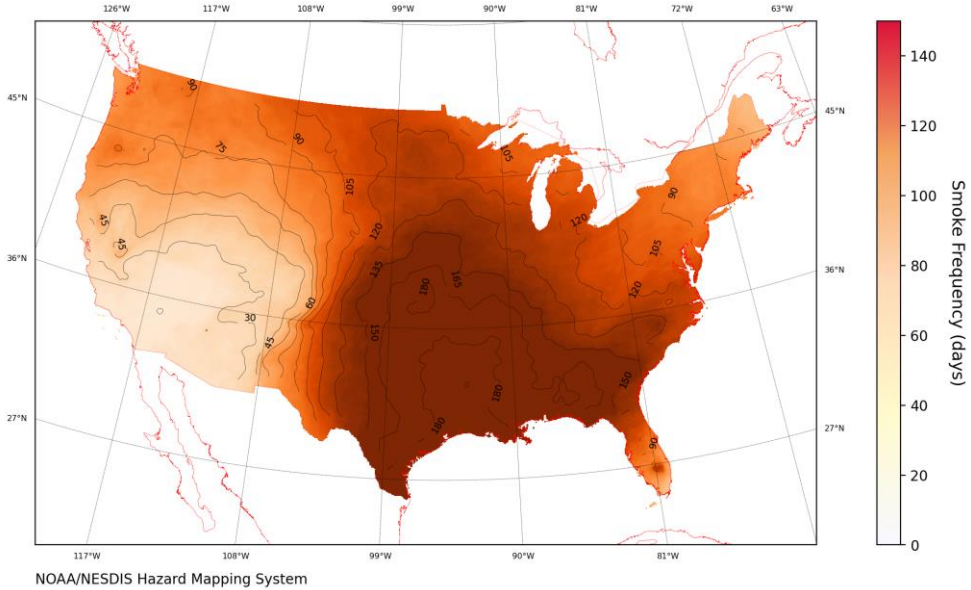
Wildfire Smoke Influence on PM2.5

- Wildfire smoke significantly influences PM2.5 concentrations, often leading to substantial increases in levels, especially in areas near and downwind of fires
  - This increase is due to the fine particulate matter present in the smoke, which can travel long distances and affect air quality far from the fire source
- The following slide shows that for much of the past few years, the cumulative smoke distribution, or the spatial and temporal pattern of smoke accumulation from wildfires over each year, has been extremely prevalent, especially in the eastern U.S.
- The maps are derived by aggregating daily smoke data, using the Hazard Mapping System (HMS), into a grid and counting the number of days each cell was covered by smoke

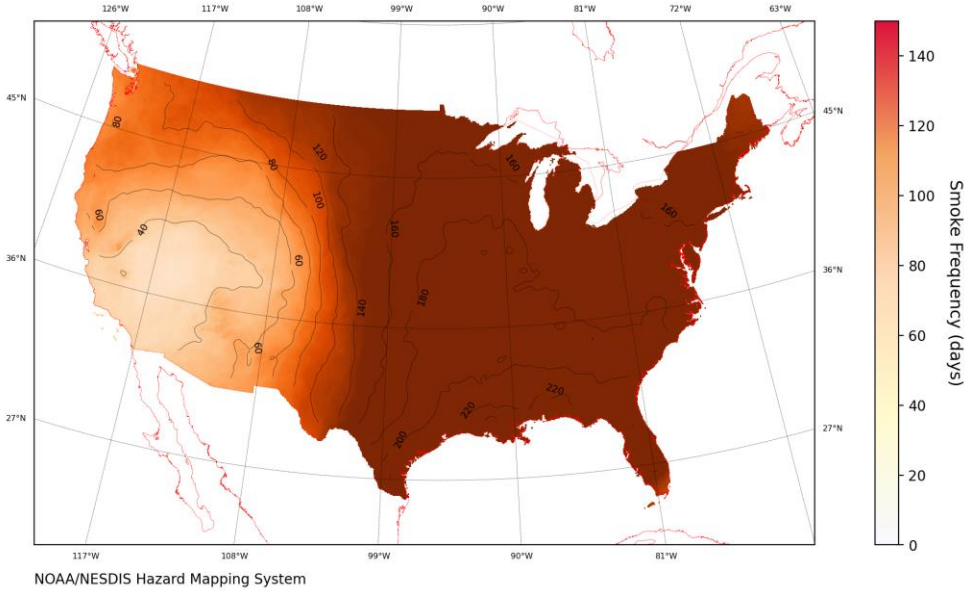
Cumulative Smoke Distribution (CONUS) 2021



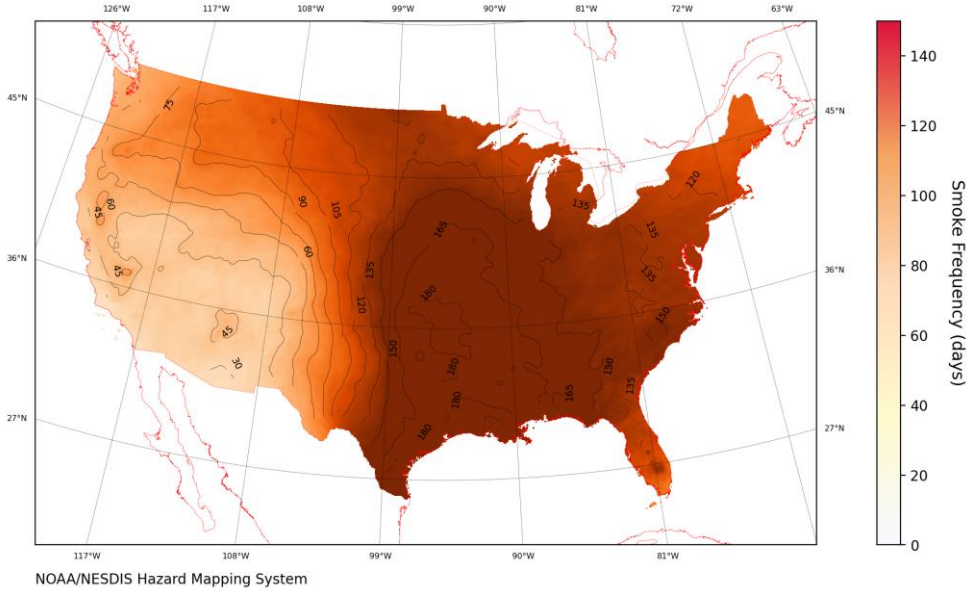
Cumulative Smoke Distribution (CONUS) 2022



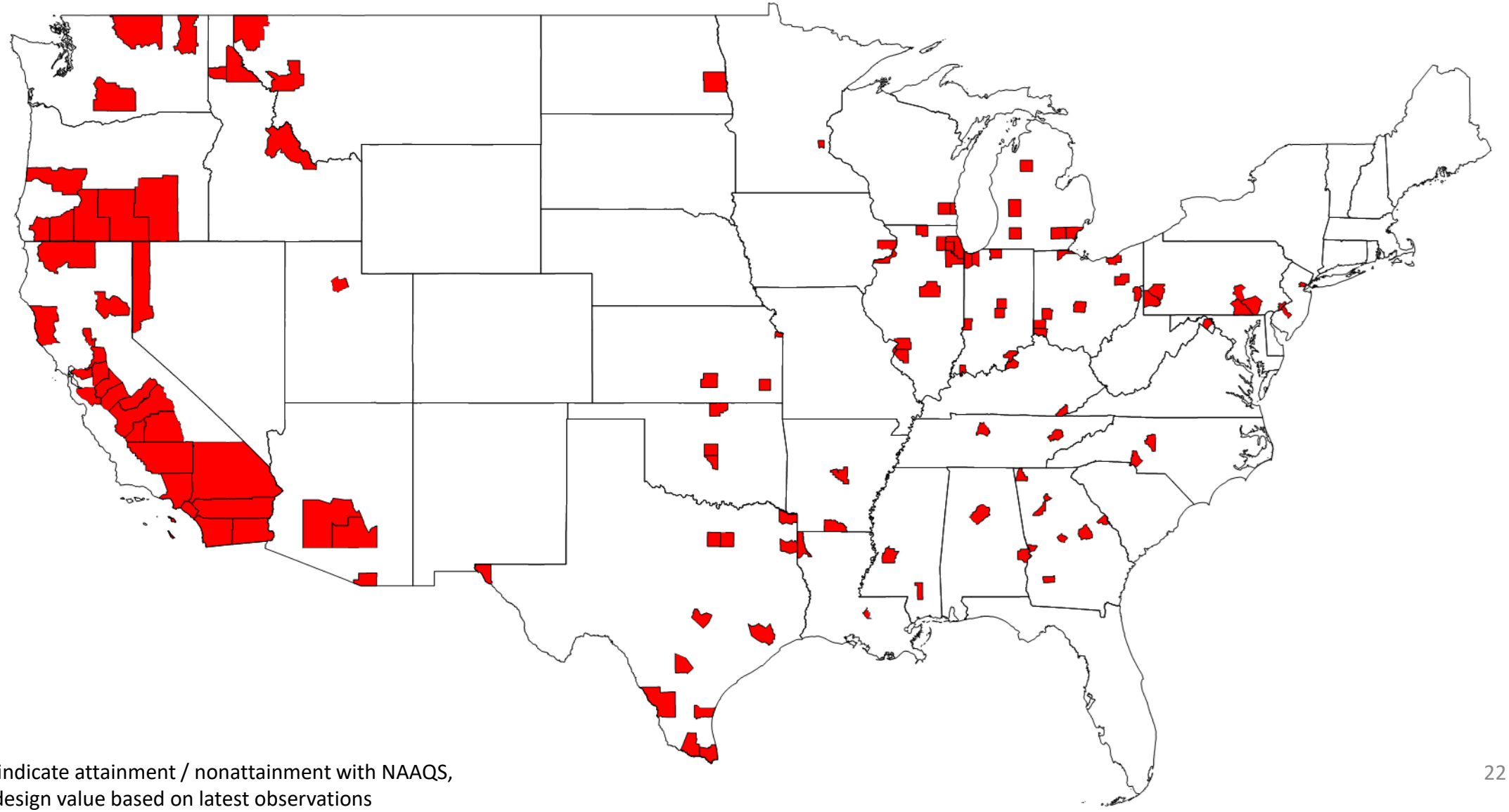
Cumulative Smoke Distribution (CONUS) 2023



Cumulative Smoke Distribution (CONUS) 2024



Counties with 2021-2023 Annual $PM_{2.5}$ DV > 9.0 µg/m^3



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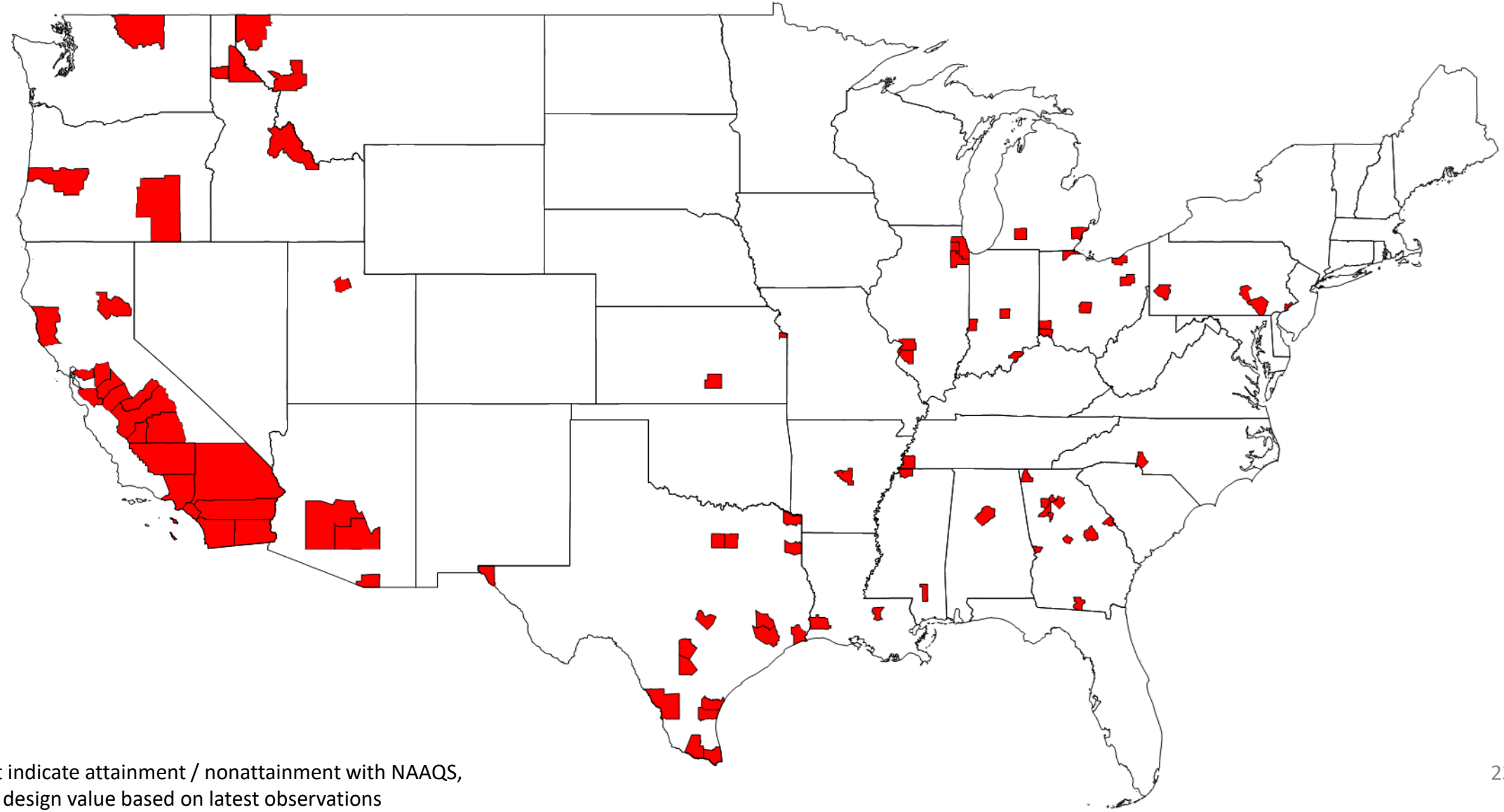
Counties with 2022-2024 Annual $PM_{2.5}$ DV > 9.0 µg/m^3



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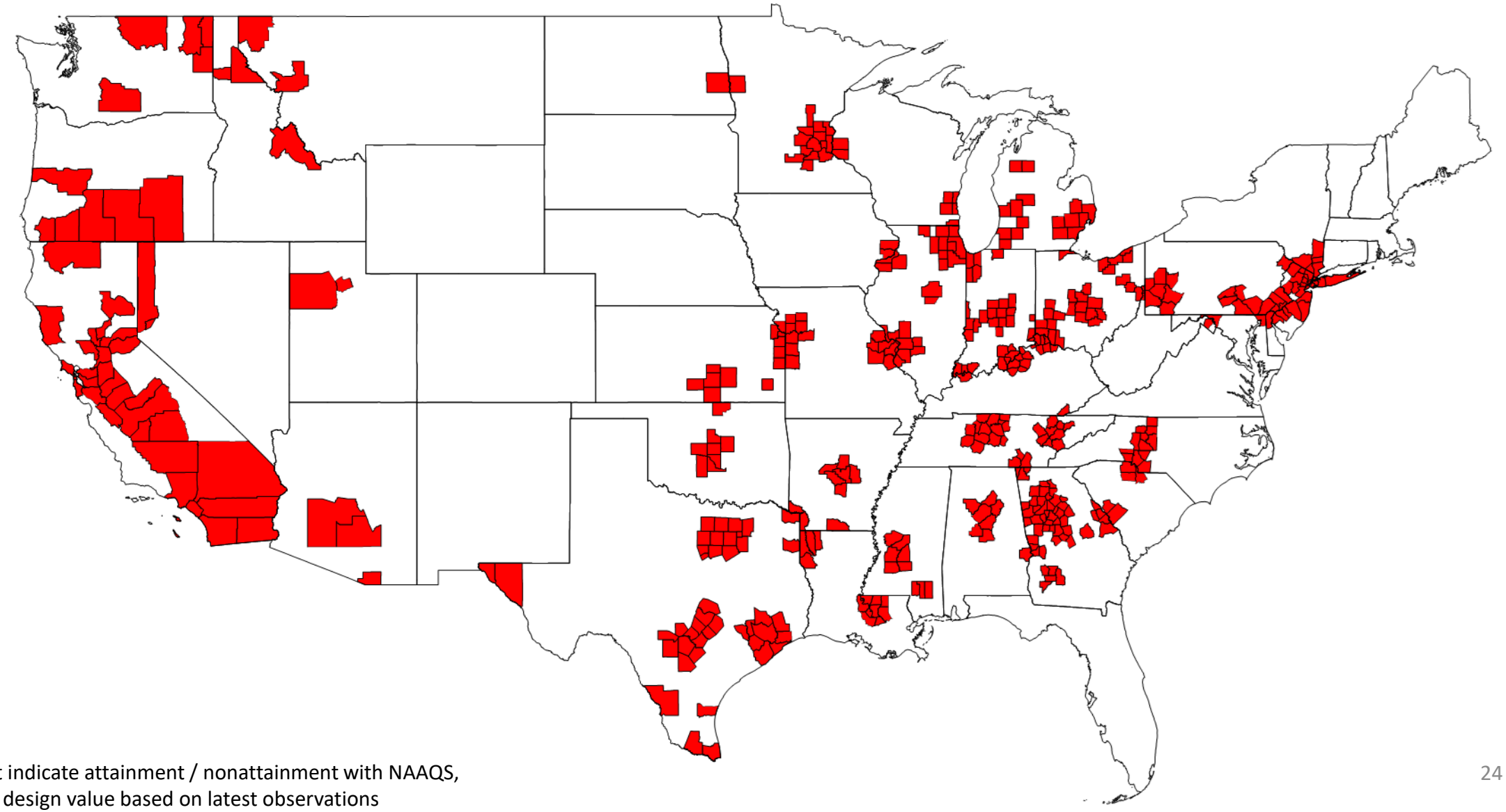
CBSA with 2021-2023 Annual $PM_{2.5}$ DV > 9.0 µg/m^3



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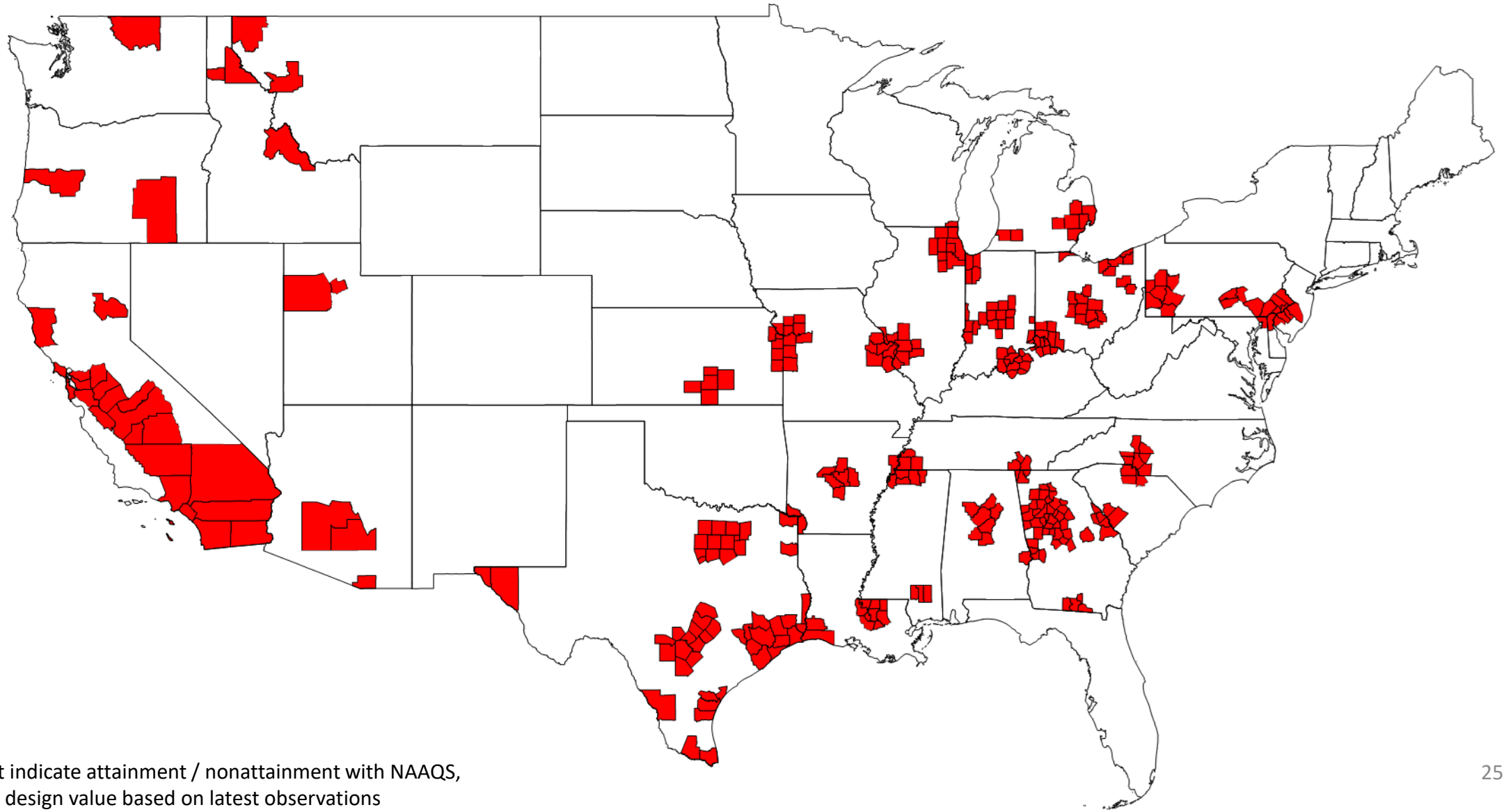
CBSA with 2022-2024 Annual $PM_{2.5}$ DV > 9.0 µg/m^3



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CBSAs with 2022-2024 Annual PM2.5 DV > 9.0 µg/m^3

CBSA Name	CBSA Value	CBSA Name	CBSA Value	CBSA Name	CBSA Value
Atlanta-Sandy Springs-Roswell; GA	9.4	Eugene; OR	14.0	Memphis; TN-MS-AR	9.6
Augusta-Richmond County; GA-SC	9.5	Fairbanks; AK	12.3	Merced; CA	9.6
Austin-Round Rock; TX	10.0	Fresno; CA	13.6	Missoula; MT	9.4
Bakersfield; CA	14.4	Hanford-Corcoran; CA	12.8	Modesto; CA	10.9
Baton Rouge; LA	9.2	Harrisburg-Carlisle; PA	9.4	Nogales; AZ	9.3
Beaumont-Port Arthur; TX	9.6	Hattiesburg; MS	9.4	Philadelphia-Camden-Wilmington; PA-NJ-DE-MD	10.3
Birmingham-Hoover; AL	11.0	Houston-The Woodlands-Sugar Land; TX	12.6	Phoenix-Mesa-Scottsdale; AZ	10.6
Brownsville-Harlingen; TX	14.4	Indianapolis-Carmel-Anderson; IN	11.6	Pittsburgh; PA	10.7
Canton-Massillon; OH	9.3	Kalamazoo-Portage; MI	10.0	Riverside-San Bernardino-Ontario; CA	12.5
Charlotte-Concord-Gastonia; NC-SC	9.2	Kansas City; MO-KS	9.2	San Antonio-New Braunfels; TX	9.5
Chattanooga; TN-GA	10.3	Kingsville; TX	9.8	San Diego-Carlsbad; CA	13.2
Chicago-Naperville-Elgin; IL-IN-WI	10.2	Lake Charles; LA	9.3	San Francisco-Oakland-Hayward; CA	10.1
Cincinnati; OH-KY-IN	10.3	Lancaster; PA	9.4	San Jose-Sunnyvale-Santa Clara; CA	9.2
Cleveland-Elyria; OH	10.9	Laredo; TX	9.7	St. Louis; MO-IL	9.6
Columbus; GA-AL	9.7	Little Rock-North Little Rock-Conway; AR	10.3	Stockton-Lodi; CA	10.2
Columbus; OH	9.4	Los Angeles-Long Beach-Anaheim; CA	11.7	Terre Haute; IN	9.3
Corpus Christi; TX	9.4	Louisville/Jefferson County; KY-IN	9.3	Texarkana; TX-AR	10.0
Dallas-Fort Worth-Arlington; TX	9.7	Macon; GA	9.5	Toledo; OH	9.6
Detroit-Warren-Dearborn; MI	12.3	Madera; CA	9.8	Ukiah; CA	10.0
El Centro; CA	10.1	Marshall; TX	9.5	Visalia-Porterville; CA	13.1
El Paso; TX	9.6	McAllen-Edinburg-Mission; TX	10.4	Wichita; KS	9.6

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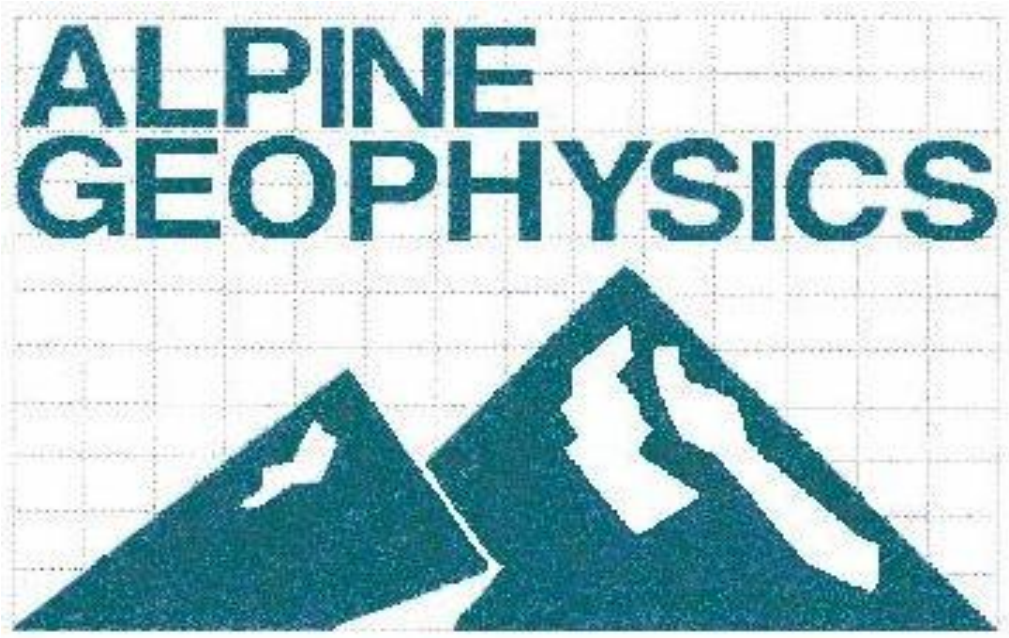

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